Feb. 6, 1951 W. S. FINHOLM 2,540,871

PIANO ACTION

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FIG. 1.

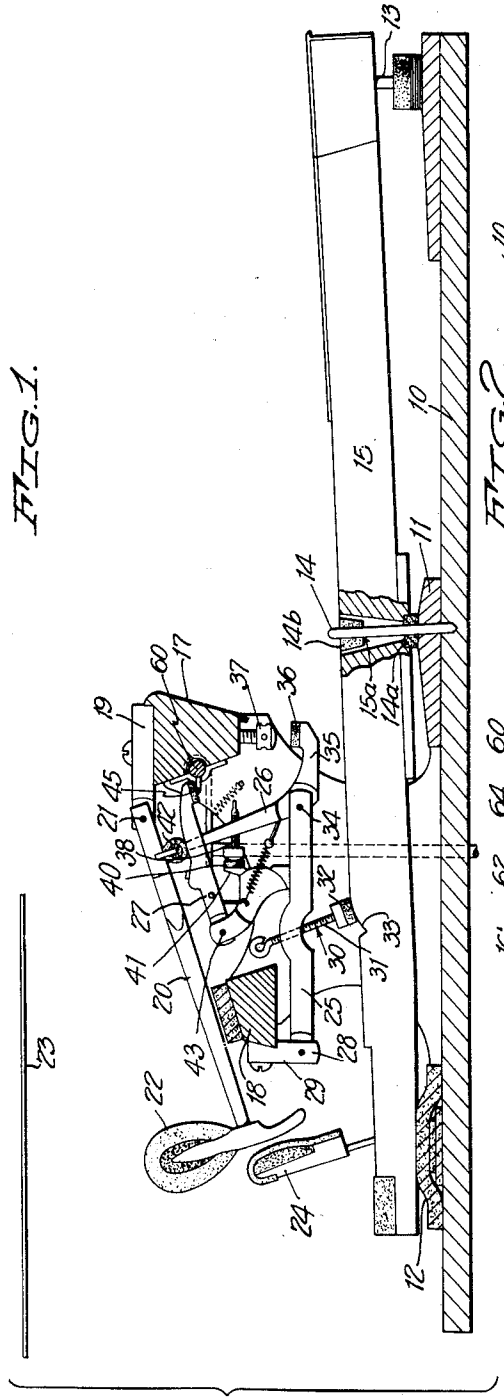

FIG. 2.

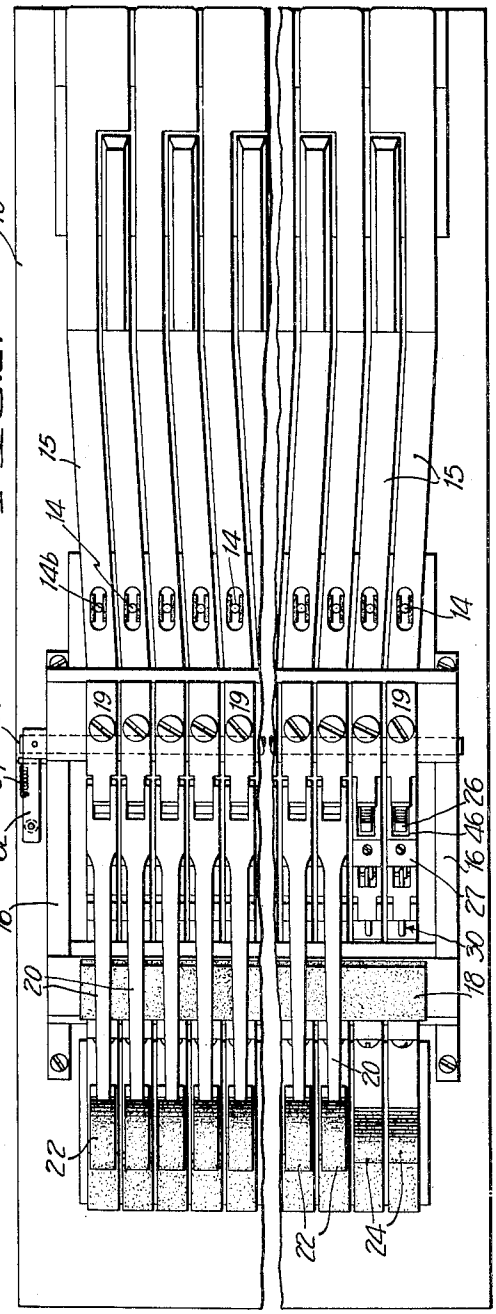

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FIG. 3.

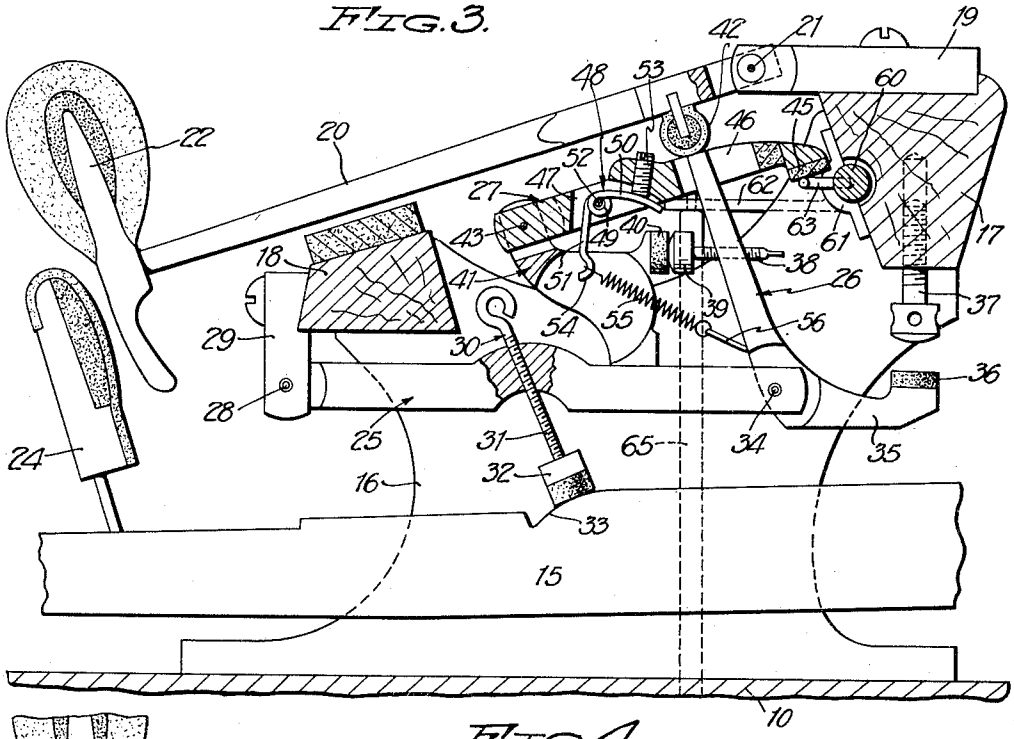

FIG. 4.

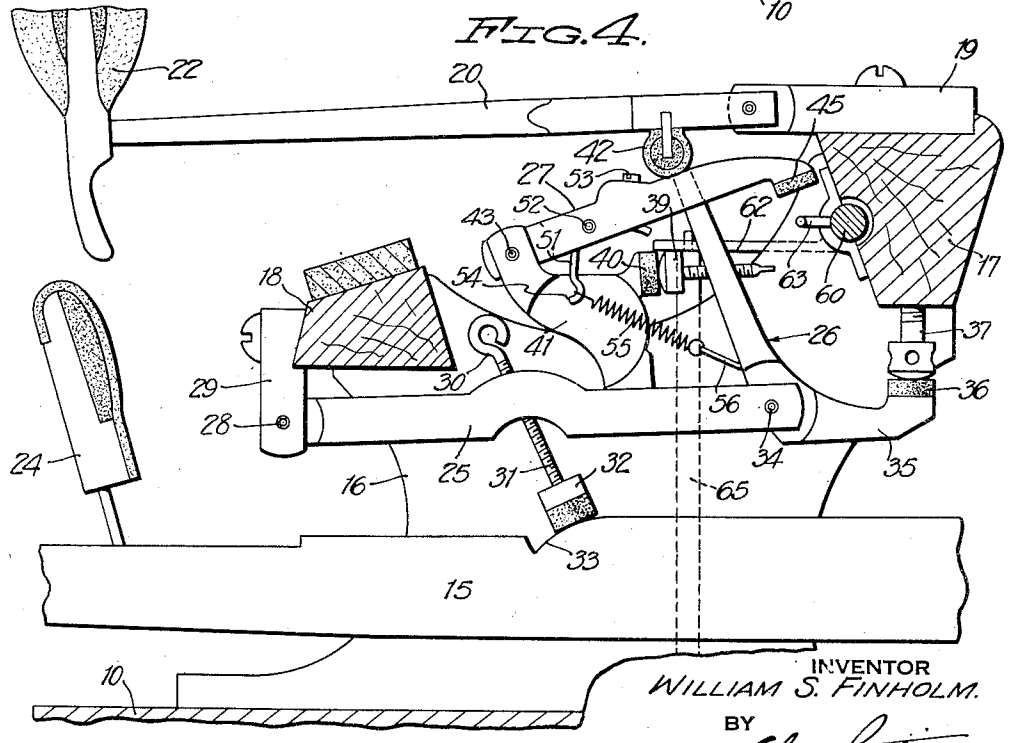

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FIG. 5.

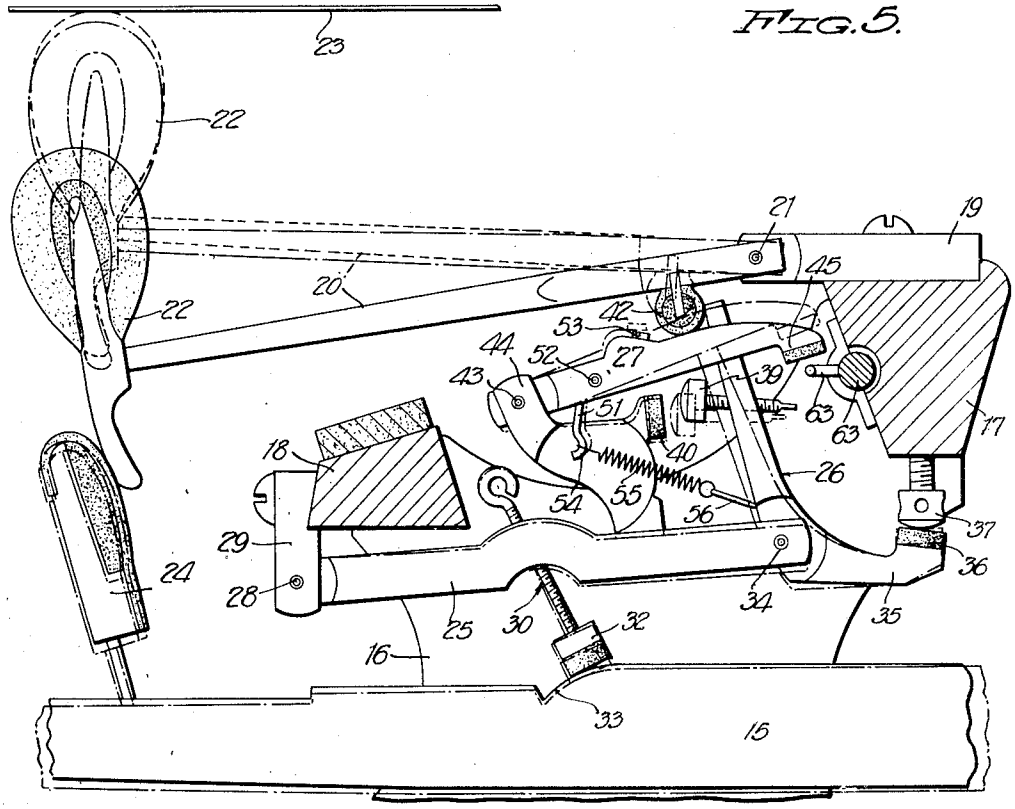

FIG. 9.

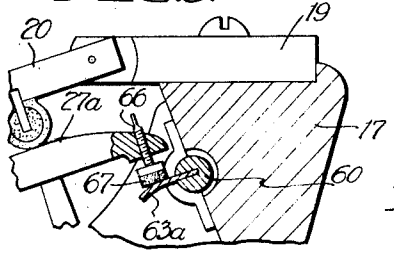

FIG. 10.

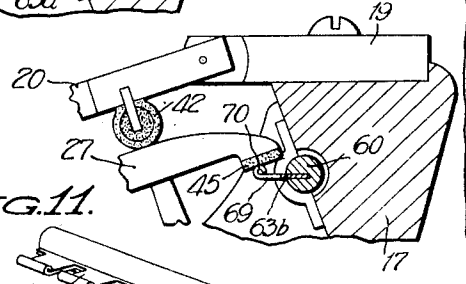

FIG. 11.

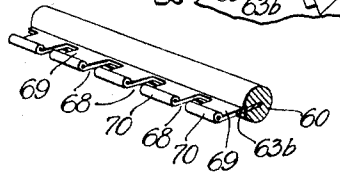

FIG. 8.

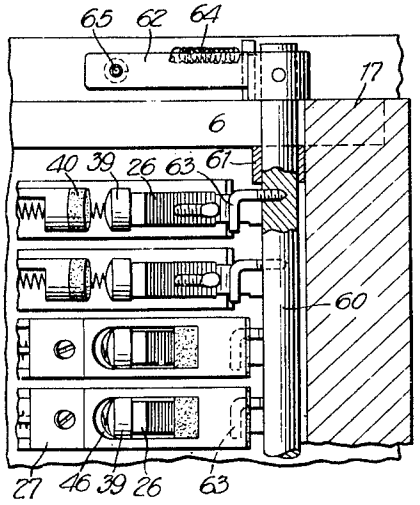

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FIG. 6.

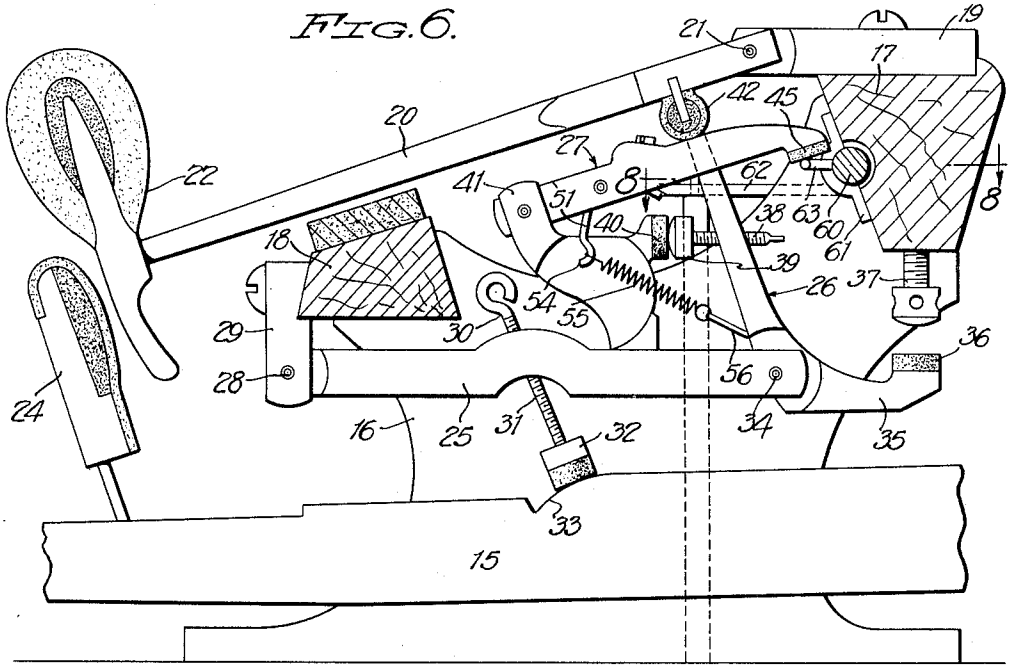
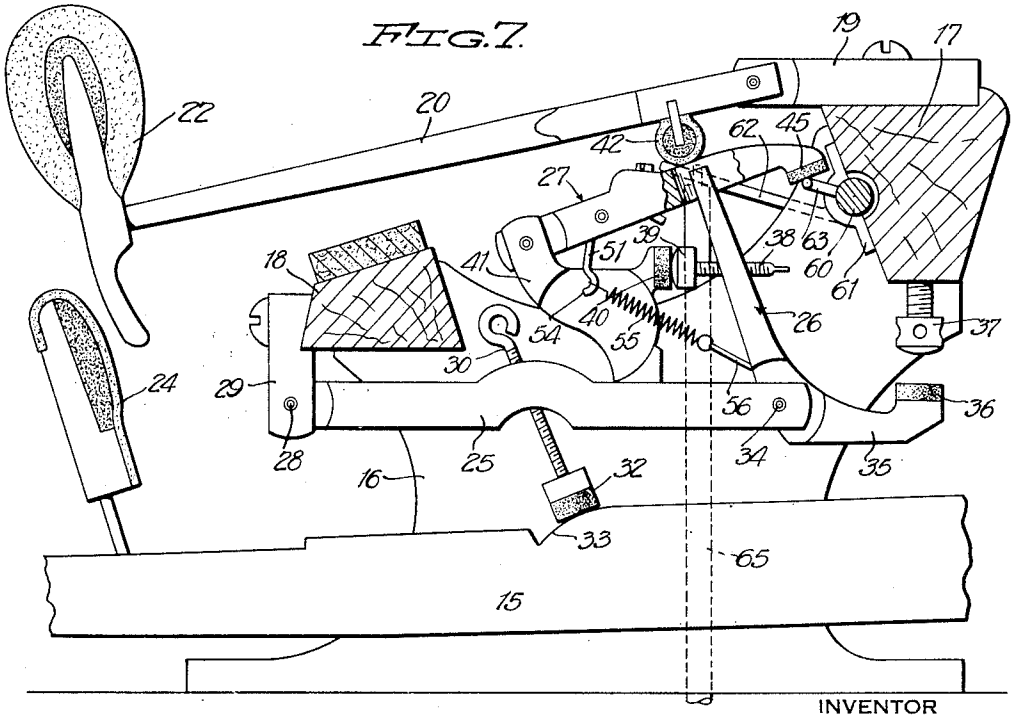


FIG. 7.



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Patented Feb. 6, 1951 2,540,871

UNITED STATES PATENT OFFICE

2,540,871

PIANO ACTION

William S. Finholm, New York, N. Y.

Application August 1, 1944, Serial No. 547,545

3 Claims. (Cl. 84—239)

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This invention relates to improvements in piano actions, and more specifically to that portion of a grand style piano action well known in the art as the "repetition."

I am aware that many types of grand piano actions have been invented, including those of my own, namely, No. 2,032,745 dated March 3, 1936; No. 2,156,913 dated May 2, 1939; and No. 2,271,633 dated February 3, 1942; which embody somewhat similar features of construction and principle of operation. However, the principles and construction involved in the invention to be hereinafter fully described are believed to be revolutionary when compared to other piano actions heretofore produced and with which I am familiar.

Some of the important features of my invention reside in a repetition mechanism for grand piano actions which is simple in construction; quiet of operation; more responsive in its operation; faster repeating; and which operates under conditions in which friction is reduced to a minimum. The features lend greater scope in responsive piano playing for the amateur as well as for the accomplished artist musician.

Another feature of the invention is to provide a repetition mechanism which enhances the touch feeling and sonority of the piano above that attained in pianos as they have been generally constructed.

A further feature of the invention is the provision of a piano action which opens a new approach to the rendition of music and its composition, for it serves to eliminate the many eccentricities of action and tone to which a pianist must normally adapt himself. It is possible for a pianist to express himself to a degree of sensitivity heretofore unknown, in tone colors ranging from the mightiest fortissimo to the faintest and most delicate variations of fine decrescendo down to pianissimo without necessitating the usual exhausting contortions in performance which are only possible by one having perfectly developed muscular control and coordination.

A further feature of the invention is to provide a grand piano action which enables a piano manufacturer to effect a saving in costly cabinet work, for it simplifies methods of assembly by eliminating a considerable part of the cabinet work, and further introduces a solid pattern of production not too dependent upon the human element so responsible for variances. Therefore, not only is the manufacturing cost to the piano maker reduced, but to the action manufacturer as well.

Many other novel features of construction will

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appear as the following specification is read in conjunction with the accompanying drawings, in which,

Figure 1 is a vertical longitudinal sectional view with parts broken away in section, taken through a grand piano action embodying my improved repetition mechanism.

Figure 2 is a top plan view of a portion of a grand piano action embodying my improved repetition mechanism.

Figure 3 is an enlarged detail vertical longitudinal sectional view through the repetition mechanism, the parts being shown in their normal position of rest.

Figure 4 is a view similar to Figure 3 but showing the position of the parts upon the initial depression of the striking key.

Figure 5 is a view similar to Figure 3 showing in full lines the position of the parts when the key is fully depressed and after the hammer has struck its string, the dotted lines indicating the position of the parts when the hammer is in striking contact with its string.

Figure 6 is a view similar to Figure 3 but showing the repetition lever and wippen in side elevation to more clearly illustrate the soft pedal rail mechanism.

Figure 7 is a view similar to Figure 6 but showing the soft pedal rail in lifting engagement with the repetition lever, the latter being broken away and shown in section.

Figure 8 is a fragmentary horizontal sectional view on the line 8—8 of Figure 6.

Figure 9 is a detail vertical sectional view through a modified form of soft pedal rail.

Figure 10 is a detail vertical sectional view of another modified form of soft pedal rail.

Figure 11 is a detail sectional perspective view of the soft pedal rail shown in Figure 10.

Referring to the drawings by reference characters, the numeral 10 designates the key frame of a grand piano on which a balance rail 11 is mounted, together with a key rest 12, front pin 13, and a key balancing adjusting pin 14. The finger operated actuating keys are designated 15, there being a sufficient number of keys as is necessary to make up a standard piano keyboard. The pin 14 is surrounded by a felt balance button 14a glued into the key 15 at the lower end of a downward tapering hole 15a provided therein. The upper end of the pin 14 carries a tapered felt pad 14b which is disposed within the hole 15a.

Supported by the key frame 10 at opposite ends thereof are upstanding brackets 16—16' which support front and rear rails 17 and 18 respec-

tively. The rail 17 supports the hammer shank flanges 19, to each of which a hammer shank 20 is pivotally connected as at 21. Carried by the free end of each hammer shank 20 is a hammer 22 which is adapted to strikingly engage its respective string 23. Each key 15 carries the conventional back check 24 for checking the down strike of its related hammer 22.

The construction so far described is conventional in grand piano actions except the balancing button feature as above described, and it is the novel construction of repetition mechanism now to be described that constitutes a decided advance in the art of repetition mechanisms. There is one repetition mechanism associated with each of the keys 15 and its related hammer 22, therefore, a description of one of such repetition mechanisms will suffice for the others.

Each repetition mechanism broadly includes a wippen 25, fly or jack 26, and a repetition or balancing lever 27, all of which cooperate to transfer a striking force from the key 15 to its related hammer 22.

The wippen 25 has its rear end pivoted at 28 to a flange 29 depending from the rear supporting rail 18. The wippen is normally supported in a substantially horizontal position by a wippen regulating screw 30, the threaded shank 31 of which is threaded through the wippen. The lower end of the shank 31 carries a padded head 32 which has constant bearing engagement with the rounded shoulder 33 provided on the top of the key 15.

The front end of the wippen 25 is bifurcated, and pivoted therein as at 34 is the lower end of the fly 26. Integral with the lower end of the fly 26 and extending forwardly therefrom is a tail piece 35 having a felt cushion 36 disposed beneath the head of a regulating screw 37 which threads into the underside of the supporting rail 17. Threaded through the fly 26 is an adjustable stop screw 38, the head 39 of which normally abuts a felt stop pad 40 carried by a fixed support 41 carried by the wippen 25. The screw 38 is adjustable to regulate the normal position of rest of the fly relative to the leather knuckle 42 carried by the underside of the hammer shank 20, and with which the free upper end of the fly operatively engages.

The repetition or balancing lever 27 is disposed in rearwardly converging relation to the wippen 25 and has its rear end pivoted at 43 to spaced ears 44 formed integral with the support 41. The forward free end of the repetition lever 27 terminates in spaced proximity to the supporting rail 17 and has a felt pad 45 on the underside thereof. The repetition lever is provided with a pair of spaced vertical slots 46 and 47. The upper end of the fly 26 freely extends through slot 46 and when at rest it terminates in alinement with the top edges of the side walls of the slot 46.

The fly 26 and repetition lever 27 are held in their normal position as shown in Figure 3, by a novel spring tension mechanism, which mechanism acts to urge the fly rearwardly in the direction of the stop pad 40, and also urges the repetition lever upwardly. The spring force acting upon the repetition lever is insufficient to lift the same under the weight of the hammer 22, but such force is sufficient to cause the repetition lever to constantly engage the knuckle 42 when the hammer is lifted by the fly 26 during the striking force imparted to the key 15. The aforementioned spring mechanism and the means for adjusting the tension thereof will now be described.

The spring mechanism which is common to both the repetition lever and the fly includes a rigid adjusting member 48 formed from a single length of metal wire which is formed with a coil portion 49 intermediate its ends. Extending from the coil portion 49 are substantially right angularly disposed arms 50 and 51. The coil portion 49 is disposed in the slot 47 and has an anchor pin 52 extending through the eye thereof with the ends of the pin secured in the opposed walls of the slot. The arm 50 abuts the end of a tension adjusting screw 53 which is threaded downwardly through the lever 27 with its inner end extending into the slot 47. The arm 51 depends from the repetition lever and terminates in a hook 54. Connected to the hook 54 is one end of a helical contraction spring 55, the other end of said spring being connected to the lower portion of the fly 26 by a flexible non-elastic cord 56. The spring 55 is normally under a very slight tension, which tension may be regulated by the adjusting screw 53.

With the parts of the action in their normal position of rest as shown in Figures 1 to 3 inclusive, assume that a striking impulse is imparted to the keyboard end of one of the keys 15. The front end of the key will be depressed while the rear end rises causing the parts to assume the initial actuating positions illustrated in Figure 4. As the rear end of the key rises, it lifts the repetition mechanism as a unit, through the wippen screw 30 and wippen 25. As the wippen moves upwardly on the pivotal axis of the pivot 28, the fly 26 lifts the hammer 22 and starts it on its upward striking movement. The only pivoted parts of the repetition mechanism which have moved on their pivotal axis so far, are the wippen 25 and hammer 22. The tailpiece 35 of the fly is now in striking engagement with the fly regulating screw 37, which causes the fly to rock forwardly on its pivot 34 away from position of rest under the knuckle of the hammer shank. As the fly rocks forwardly, the top end thereof imparts an upward force to the knuckle 42 as it forcibly slides thereagainst from the position shown in dot and dash lines in Figure 5 to the full line position thereof. The forceful sliding of the top of the fly against the knuckle imparts the string-striking blow to the hammer 22 as shown in dotted lines in Figure 5. During the actuation of the fly 26, the weight of the hammer is relieved from the fly 26 by the repetition lever 27; for the member 48 under the influence of the spring 55, pushes the repetition lever upwardly so as to maintain its contact with the knuckle 42. Thus, the repetition lever 27 acts to relieve the friction between the fly and knuckle during actuation of the escapement. Upon the completion of the striking impulse imparted to the key 15 and while the key is still held down, the top end of the fly assumes a position forward of the knuckle 42, at which time the weight of the hammer is again supported by the repetition lever 27, which has moved down from the limit of its upward movement shown in dot and dash lines in Figure 5 to the full line position thereof. Thus there is a downward yielding movement of the repetition lever relative to the fly during this stage of operation. After the hammer 22 has struck the string 23 and the key 15 is still depressed, the hammer 22 is forced to the position shown in full lines in Figure 5 where it is caught upon the back check 24. Immediately upon the

release of the key 15, the front end thereof returns to its raised position by reason of the overbalancing weight of the repetition mechanism which is supported by the key rearward of its balancing pin 14. As the key 15 is released, the spring 55 pulls the top end of the fly 26 in a rearward direction simultaneously with the upward thrust movement of the repetition lever 27 and downward movement of the repetition mechanism as a unit, whereupon the top end of the fly rides against the knuckle 42 to its normal position of rest. The return movement of the fly is limited by the head 39 of the stop screw 38 striking the stop pad 40. The stop screw 38 facilitates for the adjustment of the return movement of the fly in case of wear between the fly and the knuckle.

From the foregoing description it will be understood that the repetition lever 27 acts to counterbalance the weight of the hammer by concentrating its weight over the lifting shoulder 33 instead of over the pivot connection between the wippen and fly as is the practice in piano actions of the past. Also, the repetition lever 27 acts as a thrust lever in lifting the hammer 22 as the fly 26 returns to a position of rest. This action is accomplished more coordinately in this improved construction because the same equalizes spring tensions necessary for such functioning.

A grand piano action constructed in the manner herein described embodies many features over prior piano actions with which I am familiar and which are enumerated as follows:

1. The pianist feels no friction in a complete follow-through or striking a key either softly or heavily.

2. A lifting force is exerted as the escapement of the repetition mechanism takes place to free the greatest point of friction found in all pianos. This friction point has always been a most objectionable feature in attempting to play pianissimo, for one either pressed the key too far or not far enough.

3. The life of the action is prolonged by reducing the most serious cause of breakdown, namely, friction. Heretofore, breakdown due to friction often occurs after little use of the piano.

4. The freedom of escapement present in the repetition mechanism tends to beautify the tone of the piano because the hammer gets away faster from the string on percussion without the usual accompanying noises of action parts. It is common in other actions to give forth definitely muffled tones on fast repetition or faint pianissimo touches.

5. Tone color in all ranges possible is obtained by my action and which is lacking in prior actions.

6. The pianist senses perfect control through balance. Static friction is reduced to a minimum because of the free sliding movement of the repetition lever 27 which relieves the fly 26 of the burden of the hammer 22 as it is lifted by the knuckle 42.

7. The continuous downward tension caused by the spring 55 keeps the parts intact regardless of the momentum of the leads in any movement of the levers and without wabbling.

8. The use of a coil spring 55 maintains a more constant and even tension on the fly 26 and repetition lever 27. Also equalization is provided between the fly and repetition lever by reason of the more even spring thrust tension created by the spring which overcomes exaggerated rebound of the key 15 and hammer 22. Other actions have abnormal and uneven thrust in repeating because of the type of spring used, or by friction involved in its operation or both. Also, by reason of the equal distribution of the spring tensions operating in the right direction, my improved action functions better as a whole.

9. Repetition and acceleration in pianos is not alone dependent on key return for a new strike but greatly upon the fly return. The freedom of moving parts to a position of rest for a new strike makes speed in this improved action incomparable. This is accomplished without the use of the conventional drop screws.

10. By the use of my action, the pianist senses excellent control of the key which stays with the finger, in contrast to other actions in which the key can be bounced away from the finger.

11. The repetition lever 27 helps to concentrate the varying weights of hammers, shanks, and knuckles at the capstan lifting point rather than at the wippens extremities which is inducive of a greater uniformity of touch feeling over the entire keyboard.

12. And finally, this new combination and arrangement of parts makes possible a workable action in miniature with all parts accessible for regulation. Such construction enables the piano manufacturer to effect an improvement in design, for the case can be reduced in depth as well as in length to produce a relatively small or miniature grand piano.

Associated with the repetition mechanism of my improved action is a novel construction of soft pedal mechanism by which the same key level of the keys may be maintained when the soft pedal of the piano is used. One form of soft pedal mechanism is illustrated in Figures 1 to 8 inclusive and includes a rocker shaft 60 journalled in bearings 61 along the rear side of the rail 17. The shaft 60 extends the full length of the action and has its ends extending beyond the ends of the rail. One extending end of the shaft 60 has a rearwardly extending arm 62 fixedly secured thereto. Fixedly carried by the shaft 60 equidistantly therealong is a row of lifting or soft pedal stop elements 63. There is a lifting element 63 engageable with each repetition lever 27 of the action and they respectively underlie the pads 45 at the free ends of the respective levers. In this instance, the lifting elements are in the form of screw hooks having their threaded shanks screwed into the shaft 60 so that they project radially therefrom. The lifting elements 63 are normally held out of lifting engagement with their respective repetition levers by a contractile spring 64 which has one of its ends attached to the arm 62 and its other end fixed to the adjacent end bracket 16. A vertical actuating rod 65 has its upper end flexibly connected to the free outer end of the arm 62 while its other end is connected to a depressible soft pedal (not shown). An upward push upon the rod 65 by the depressing of the soft pedal will cause the arm 62 to swing upwardly thus causing the shaft 60 to rock, whereupon the lifting elements will swing up against the pads 45 and lift the free ends of the repetition levers 27 from the position shown in Figure 6 to the position shown in Figure 7. The lifting elements 63, in their position of rest, prevent the hammers 22 from sinking too deep into the back check 24 when playing fortissimo and help to prevent chocking. When the pressure upon the soft pedal is released, the rod 65 will move downward causing the shaft 60 to turn in a direction to swing the

lifting elements 63 downwardly away from the repetition levers 27, which levers under the action of the spring will return to their normal position of rest as shown in Figure 3. It will be noted by reference to Figure 7 that when the soft pedal is in use, the connection at the spring adjusting hook 51 operates in substantially straight lines so that the spring tension is more constant and the touch is little affected. Also, the knuckles 42 push downwardly on their respective repetition levers at all times, thus providing an efficient means of maintaining the same key level when the soft pedal is used. The novel form of soft pedal mechanism herein shown and described eliminates the exacting cabinet work usually necessary in the manufacture of grand pianos for the same tone is softened by hitting the same point as on forte.

In Figure 9 of the drawing a modified form of soft pedal-operated repetition lever lifting means is illustrated. In this form, the shaft 60 has a rigid plate 63*a* extending radially therefrom and which extends beneath all of the free ends of the repetition levers 27*a*. The free end of each lever 27*a* carries a regulating screw 66 having a pad 67 disposed in the path of upward movement of the plate 63*a*, in order to keep the hammer line even throughout the action. The free longitudinal edge of the plate 63*a* is curved downwardly so as to smoothly ride against the pads 67. It will be understood that when the shaft 60 is rocked in a clockwise direction, the plate 63*a* will swing upward and simultaneously lift all of the levers 27*a* to soft pedal operating position.

In Figures 10 and 11 a further modification of repetition lever lifting means is illustrated wherein a rigid plate 63*b* is fixed to the shaft 60 and extends radially therefrom. The outer edge of the plate 63*b* is provided with spaced notches 68 which divide the extending portion of the plate into spaced lifting fingers 69 respectively disposed beneath the pads 45 of the repetition levers 27. The free ends of the fingers 69 are rolled to provide beads 70 which contact with the pads 45 and reduce the friction between the repetition levers and the fingers of the lifting plate. It will be understood that when the soft pedal is applied and the shaft 60 is rocked to swing the plate 63*b* upwardly, the fingers 69 will simultaneously lift the free ends of the repetition levers to soft pedal position.

While I have shown and described what I consider to be the preferred embodiment of my invention, I wish it to be understood that such changes in construction, design, and materials as come within the scope of the appended claims may be resorted to without departing from the spirit of my invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a piano action, a hammer having an operating knuckle; a repetition mechanism including a wippen having one of its ends pivoted to a fixed support, a fly lever pivoted to the other end of the wippen, a repetition lever having one of its ends pivoted to said wippen, a contractile spring having one of its ends fixedly connected to the fly lever, a rigid connecting member carried by said repetition lever having an arm extending downwardly therefrom and to which the other end of the contractile spring is connected, the points of connection between the ends of said spring and the fly lever and arm respectively being in substantial alinement with the pivotal axes of the fly lever and repetition lever to impart an even tension thereto, the tension upon the repetition lever acting to relieve the weight of the hammer upon said fly lever at all times.

2. In a piano action, a repetition mechanism including a wippen having one of its ends pivoted to a fixed support, a fly lever pivoted to the other end of said wippen, a repetition lever having one of its ends pivoted to said wippen, spring tension means common to said fly lever and said repetition lever and acting to impart an upward yielding thrust to said repetition lever; and a hammer having an operating knuckle resting upon the free end of the repetition lever in operative relation to the fly lever, said spring tension means as it acts upon the repetition lever serving to relieve the weight of the hammer upon the fly lever to reduce friction between the fly lever and the knuckle to a minimum during actuation of the fly lever, the spring tension means comprising a contractile spring having one of its ends fixedly connected to the fly lever, the repetition lever having a slot therein, an anchor pin bridging said slot, a rigid connecting member mounted on said anchor pin, said connecting member having a downwardly extending arm to which the other end of said spring is fixedly secured and a second arm angularly disposed relative to the first mentioned arm, and an adjusting screw threaded in the repetition lever and extending into said slot and against which the second arm forcibly engages.

3. In a piano action, a hammer having an operating knuckle on the underside thereof; a repetition mechanism including a wippen, a fly lever pivoted to said wippen, a repetition lever having one of its ends pivoted to said wippen and its other end free, the free end of the repetition lever being disposed beneath said knuckle, a tensioned contractile helical spring, a flexible non-elastic element connecting one end of said spring to said fly lever, a rigid connecting member carried by said repetition lever to which the other end of said spring is connected to impart a constant yieldable thrust to the repetition lever to relieve the weight of the hammer from the fly lever while the fly lever is at rest and during operation thereof, and a key having an inclined shouldered portion beneath the wippen and adjusting screw carried by the wippen, said screw having a pad on the end in bearing contact with the inclined shouldered portion of the key.

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